Q. How do I setup the NPSM using the Reach File 3 (RF3) stream network coverage?

A. BASINS 2.0 provides the option of modeling stream networks based on either the Reach File, V1 (RF1) or Reach File, V3 (RF3) data layers. As described in Section 7.1 of the BASINS user manual, the user defines which Reach File to be modeled when creating (delineating) or importing watershed boundaries. The higher resolution of RF3 allows users to delineate smaller subwatersheds as well as model a more detailed stream network, enabling the user to better assess the distribution and impact of nonpoint source pollutants within a watershed.

This FAQ provides guidance on how to setup the NPSM when modeling RF3 stream segments. The RF3 theme does not always contain the necessary information to build a stream network nor does it contain the necessary physical parameters (e.g. width, depth, mannings N) to create the functional tables (FTABLEs) required by NPSM. The user, therefore, needs to manually create the stream network and populate the stream characteristic and FTABLE data fields. The following is a step by step process for initially setting up the NPSM for modeling RF3 stream reaches and obtaining data to estimate missing parameters.

NPSM Initialization

Once subwatersheds have been delineated for the RF3 stream system, the NPSM can be initialized from the GIS for the selected area. NPSM extracts stream data from the RF3 theme fields as summarized below in Table 1. Because RF3 does not always contain complete reach network data, the users may be prompted by the following message:

> "Selected reaches are not connected or do not contain enough information to build the stream network."

The RF3 reach network database is incomplete in many areas, particularly in headwater tributaries. The stream network must be manually re-created in either the *Reach Network* or *Reach Network Visualization* screens.

Because the RF3 does not contain the required data to build a hydraulic function table (FTABLE), the user will be prompted with the following reminder:

> "The following reaches from the GIS import file contain incomplete or invalid data: ... Please complete or edit the missing information using the Reach Editor before running the model. Most likely the slope, width, depth, or the Manning n are missing."

The list includes all reaches in the modeled stream network. Other parameters not available from the RF3 database include the elevation and delta h. Each of these parameters must be input by the user to the NPSM interface. Select OK to continue.

Table 1. Data Extracted from Reach Files during NPSM Initialization

Reach Characteristics from RCH file	RF1 Field Name	RF3 Field Name	Notes
Reach ID	Rivrch	Rf3rchid	
Reach Name	Pname	Pname	
# of Exits	None	None	Default = 1
Type (Stream/Lake)	Type	ReachType	
Watershed-ID	None	None	NPSM assigned
Headwater Flag	Type	ReachType	
Upstream left segment	Ulcsm	Ulrf3rchid	
Upstream right segment	Urcsm	Urrf3rchid	
Complementary segment	Ccsm	Curf3rchid	
Downstream segment	Dscsm	Dsrf3rchid	
Segment Length	Segl	Segl	
Delta h	Ptopele - Pbotele	None	
Elevation	(Ptopele+Pbotele)/2	None	
Mile point	Milept	Mi	
Stream Level	Lev	Level	
F-Table Information from PTF file	**RF1 Field Name**	**RF3 Field Name**	**Notes**
Reach Number	Rivrch	Rf3rchid	
Length, L (ft)	Segl	Segl or Length_m	Segl in miles, Length in meters
Mean Depth, Ym (ft)	Pdepth	None	
Mean Width, Wm (ft)	Pwidth	None	
Mannings Roughness Coeff., N	Pmann	None	
Long. Slope, S (ft/ft)	Pslope	None	
Type of x-section	None	None	Default = Trapezoid
Side slope of upper floodplain, m31, m32 (ft/ft)	None	None	Default = 0.5
Side slope of lower floodplain, m21, m22 (ft/ft)	None	None	Default = 0.5
Side slope of channel, m11, m12 (ft/ft)	None	None	Default = 1
Floodplain width, W11, W12 (ft)	None	None	Set to mean channel width, Wm
Channel Depth, Yc (ft)	None	None	Calculated Yc = Ym X 1.5
Floodplain side slope changes at depth, Yt1 (ft)	None	None	Calculated Yt1 = Yc X 1.5
Maximum Depth, Yt2 (ft)	None	None	Calculated Yt2 = Yt1 X 100
No. of exits	None	None	Default = 1
Fraction of flow through exit 1	None	None	Default = 1
Fraction of flow through exit 2	None	None	
Fraction of flow through exit 3	None	None	
Fraction of flow through exit 4	None	None	
Fraction of flow through exit 5	None	None	

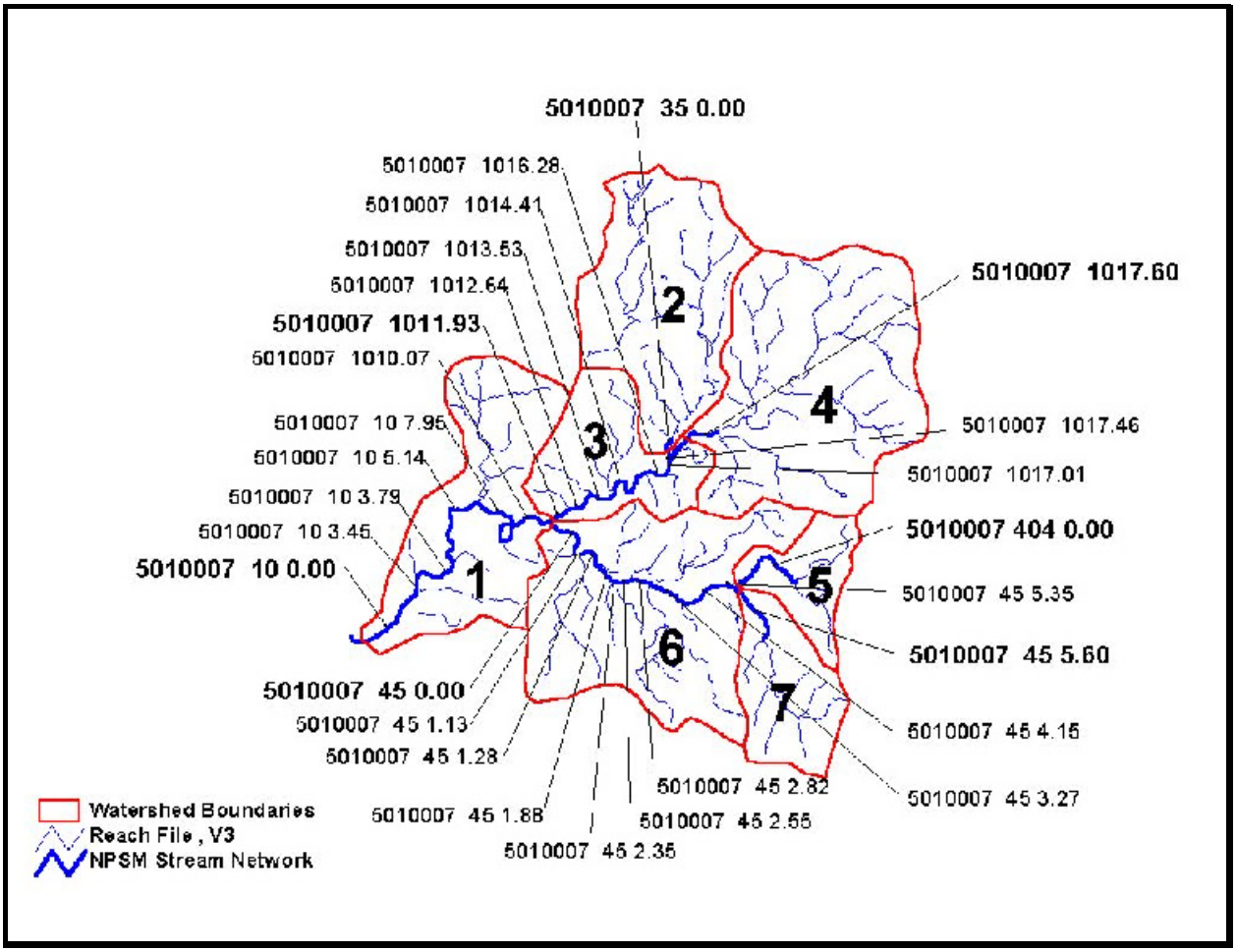
The execution of NPSM will continue as usual, prompting the user for a project file name. It is a good idea to first save the NPSM project under two different names; one as the initial setup file (e.g. INITIAL.PRJ) and a second as the file that will be edited (e.g. SETUP.PRJ). This will allow you to return to the original data extracted from the BASINS GIS, if needed.

NPSM Setup

Once the NPSM interface is open, the reach network and characteristic data can be edited from the *Reach Editor* dialog window.

Step 1: From the *Reach Editor* window select *Add/Remove Reaches* and review the list of stream segments. The RF3 reach segments extracted from the BASINS GIS interface includes all mainstem reaches within each non-headwater subwatershed and the downstream reach in each headwater subwatershed (see Figure 1). If stream data for a subwatershed is limited, or the stream is relatively homogenous, the same average values can be used for multiple reaches. In this case, the user can either use the same data for each reach within the subwatershed or delete reaches so

Figure 1. RF3 stream network extracted to NPSM.



that the subwatershed is represented by only one reach. In this second case, the user should leave the downstream reach. The downstream reach can be easily identified in the *Add/Remove Reaches* window because it has the same ID number for both the Reach # and Watershed fields. The length of the remaining reach will need to be recalculated from the RF3 coverage.

Step 2: If you received the "Selected streams are not connected..." message, create the stream network from the *Setup Reach Network* or *Reach Network Visualization* windows. Prior to making edits, one or all stream segments may appear disconnected in the *Reach Network Visualization* screen. Refer to the BASINS User Manual (p. 10.4-3) for how to edit the reach network.

It is helpful to draw a schematic of the reach network based on the original Reach File, V3 shapefile. In addition, NPSM writes a text file containing a list of the Reach IDs assigned by NPSM and the corresponding RF3 IDs and reach names from the"Rf3rchid" and "Pname" fields contained in the RF3 theme. The text file has a MAP file extension (i.e. <project name>.MAP) and is located in the BASINS/MODELOUT/ <project name> directory.

Step 3: Open the *Reach Characteristics* window and populate the missing data. Delta h (change in stream elevation from top to bottom of segment) and Elevation (average stream segment elevation) can be estimated from the Digital Elevation Model (DEM) data included with BASINS. While the length data should be complete, if you deleted a reach(es) in Step 1 you will need to update the length of the remaining reach within the subwatershed.

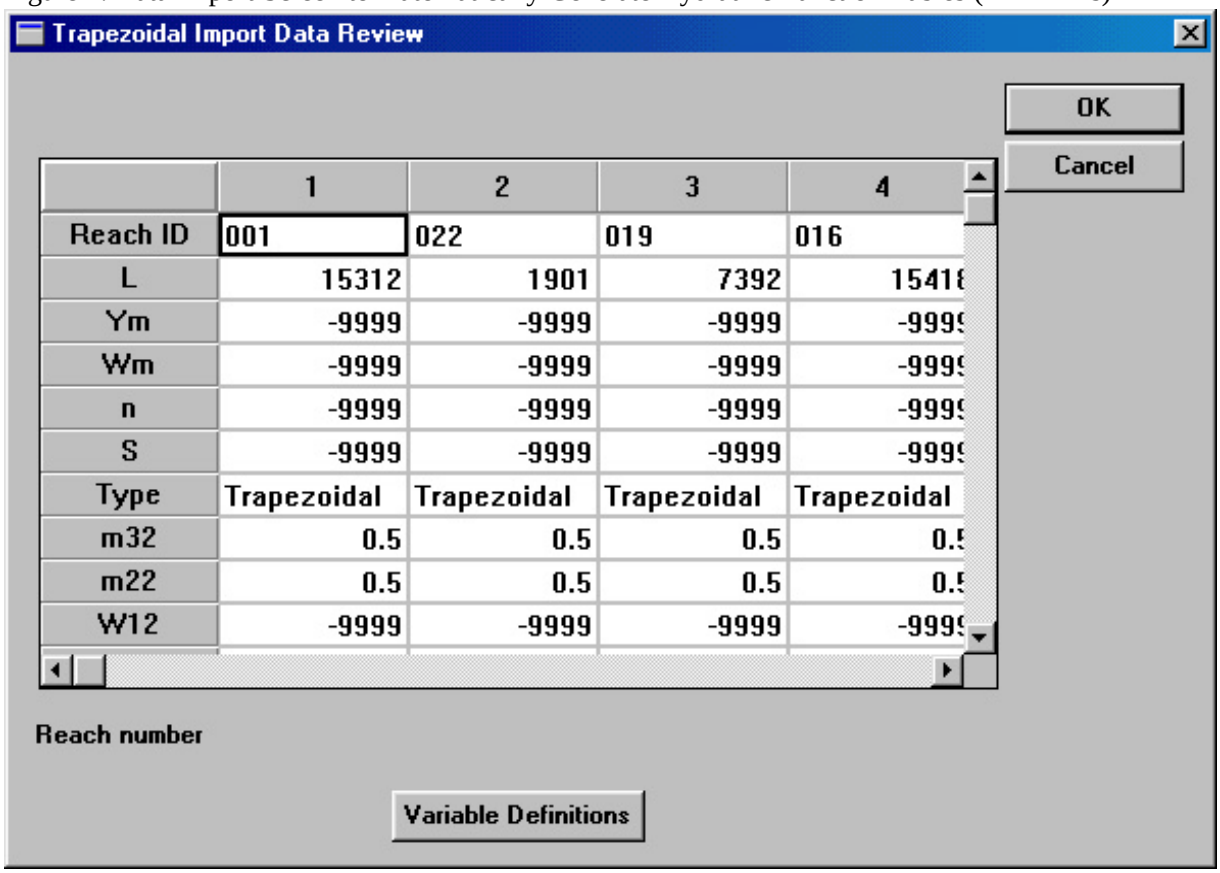
Step 4: Create an F-Table for each reach. NPSM requires that an F-Table be created for each stream segment based on its geometric and hydraulic properties. The F-table defines the functional relationship between depth, surface area, volume, and volume-dependent discharge and is used for simulating flow routing in the RCHRES module.

When you first open the F-Table window, the table may be empty. Select *Import* and open the PTF file located in the BASINS\MODELOUT\ <project name> directory. This file is created when initializing NPSM from BASINS. The PTF file for RF3 reaches will be missing data for mean depth (Ym), mean width (Wm), Mannings N (N), longitudinal slope (S), flood plain widths (W11, W12), and stream depths (Yc, Yt1, Yt2) (Figure 2). The length will also need to be updated if reaches were deleted from the original stream network. Enter the missing data and select OK to complete data import. The F-table is automatically generated based on Manning's equation using the stream geometry and slope values.

When available, field measurements of stream geometry should be used to populate the missing data in the PTF table. This data is typically available at flow and water quality monitoring stations being maintained by federal and state agencies. In addition, detailed stream cross-section data is available from the U.S. Corps of Engineers for areas where flood analysis and hazard assessments were conducted.
If flow rating cures are available for a monitoring station, these values can be entered directly into

the F-table without importing the PTF file. Check the "user edited" box, add the number of rows necessary, and enter data directly into the FTABLEs screen.

Figure 2. Data Import Screen to Automatically Generate Hydraulic Function Tables (FTABLEs)



	1	2	3	4
Reach ID	001	022	019	016
L	15312	1901	7392	15418
Ym	-9999	-9999	-9999	-9999
Wm	-9999	-9999	-9999	-9999
n	-9999	-9999	-9999	-9999
S	-9999	-9999	-9999	-9999
Type	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
m32	0.5	0.5	0.5	0.5
m22	0.5	0.5	0.5	0.5
W12	-9999	-9999	-9999	-9999

Once the F-tables are created the reach data is complete. Continue with NPSM setup as usual and run the model.